MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2018/2019

BMT1014 – MANAGERIAL MATHEMATICS

(All sections / Groups)

13 MARCH 2019
9.00 a.m – 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of **6 pages** including cover page and Mathematical formulas with **4 Questions** only.

2. Attempt **ALL** questions and write your answers in the Answer Booklet provided.

3. Mathematical formulas are provided at the end of the paper.

4. The candidate is allowed to use scientific calculators that are permitted to be used in the examination.

Question 1 (25 marks)

A farmer plans to mix two types of food to make a mix of low cost feed for the animals in his farm. A bag of food X costs RM10 and contains 40 units of proteins, 20 units of minerals and 10 units of vitamins. A bag of food Y costs RM12 and contains 30 units of proteins, 20 units of minerals and 30 units of vitamins. How many bags of food X and Y should the consumed by the animals each day in order to meet the minimum daily requirements of 150 units of proteins, 90 units of minerals and 60 units of vitamins at a minimum cost?

Table 1

	Food X	Food Y	Minimum Requirement
Proteins	40	30	150
Minerals	20	20	90
Vitamins	10	30	60
Cost (RM)	10	12	

a) Formulate a linear programming model for this problem.

[8 marks]

b) Solve the LP problem graphically and state the optimal solution.

[17 marks]

Question 2 (25 marks)

a) Find the point of intersection of the straight lines that have equations $y = x + 1$ and $y = -2x + 4$ **[4 marks]**

b) How many monthly payments of RM250 must be planned to have a future value of RM5,500 when the interest is 5% compounded monthly?

[5 marks]

c) Amelia bought a car with a down payment of RM5,000 and payments of RM790 per month for 5 years. If the interest rate is 4% compounded monthly, what is the total cost of the car?

[6 marks]

d) Dheo borrows RM250,000 at 3.6% for 35 years to purchase a house. What is his monthly payment? **[5 marks]**

Continued...

e) In 10 years, a RM40,000 machine will have a salvage value of RM4,000. A new machine at that time is expected to sell for RM52,000. In order to provide funds for the difference between the replacement cost and the salvage value, a sinking fund is set up into which equal payments are placed at the end of each year. If the fund earns 7% compounded annually, how much should each payment be?

[5 marks]

Question 3 (25 marks)

a) Differentiate the following functions:

i. $y = 5x^3 + \frac{1}{2x} - 2\sqrt{x}$

[3 marks]

ii. $f(x) = (x^3 + 1)^2 (6x^2 - 9)$

[3 marks]

b) Evaluate the given partial derivatives;

$$f(x, y) = 4x^2 + x\ln(y^2 + 1) - 7y; \qquad f_y(1, 2)$$

[4 marks]

c) A group of marine biologist at the Atlantic Institute of Oceanography recommended that a series of conversation measures can be carried out over the next decade to save a certain species of great white shark from extinction. After implementation of the conversation measures, the population of this species is expected to follow the equation

$$W(t) = 5t^3 + 2t^2 - 8t + 300;\ 0 \le t \le 10$$

Where $W(t)$ denotes the population at the end of year t. Find the rate of growth of the great white shark population when $t = 2$ and $t = 6$. How large will the great white shark population be 8 years after implementing the conversation measures?

[5 marks]

d) A small tie shop sells ties for RM3.50 each. The daily cost function is estimated to be $C(x)$ dollars, where x is the number of ties sold on a typical day and

$$C(x) = 0.0006x^3 - 0.03x^2 + 2x + 20$$

Continued...

i. Find the revenue function, $R(x)$ and the profit function, $P(x)$ for the above situation.

[3 marks]

ii. Fund the number of tie x that will maximize the shop's daily profit.

[3 marks]

iii. Compute $\overline{C}(x)$ and $\overline{C}'(x)$.

[4 marks]

Question 4 (25 marks)

a) Find each of the following:

i. $\int \frac{(\ln x)^2}{x}\,dx$

[5 marks]

ii. $\int_0^1 \left(\frac{3}{\sqrt{x}} - 2\sqrt[3]{x}\right) dx$

[5 marks]

b) The management of Colop Office Equipment has determined that the daily marginal cost function associated with producing battery-operated pencil sharpeners is given by

$$C'(x) = 0.000006x^2 - 0.006x + 4$$

where $C'(x)$ is measured in dollars per unit and x denotes the number of units produced. Management has also determined that the daily fixed cost incurred in producing these pencil sharpeners is \$100.

i. Find Colop's daily total cost for producing the first 500 units sharpener.

[5 marks]

ii. Find the total cost for producing the 201st through 400th units.

[5 marks]

c) Find the area of the region R bounded by the graphs of the following functions:

$$f(x) = x^2 - 2x - 1 \quad \& \quad g(x) = -e^x - 1$$

where $f(x)$ is the top curve and $g(x)$ is the below curve between the vertical lines $x = -2$ and $x = 2$. **[5 marks]**

End of Page

Course : Managerial Mathematics
Code : BMT 1014

Summary of Principal Formulas and Terms

Simple Interest

(i) Interest, $I = Prt$ (P = principal, r = interest rate, t = number of years)

(ii) Accumulated amount, $A = P(1 + rt)$

Compound Interest

(i) Accumulated amount, $A = P(1+i)^n$, where $i = \frac{r}{m}$, and $n = mt$

(m = number of conversion periods per year)

(ii) Present value for compound interest, $P = A(1+i)^{-n}$

Effective Rate of Interest

$$r_{eff} = \left[1 + \frac{r}{m}\right]^m - 1$$

Future Value of an Annuity

$$S = R\left[\frac{(1+i)^n - 1}{i}\right]$$ (S = future value of ordinary annuity of n payments of R dollars periodic payment)

Present Value of an Annuity

$$P = R\left[\frac{1-(1+i)^{-n}}{i}\right]$$ (P = present value of ordinary annuity of n payments of R dollars periodic payment)

Amortization Formula

$$R = \frac{Pi}{1-(1+i)^{-n}}$$ (R = periodic payment on a loan of P dollars to be amortized over n periods)

Sinking Fund Formula

$$R = \frac{Si}{(1+i)^n - 1}$$ (R = periodic payment required to accumulate S dollars over n periods)

Basic Rules of Differentiation

(i) Chain rule: Derive $g[f(x)] = g'[f(x)]f'(x)$

(ii) General power rule: Derive $[f(x)]^n = n[f(x)]^{n-1} f'(x)$

(iii) Exponential function: Derive $e^x = e^x$

(iv) Derive $\left(e^{u}\right)=e^{u}\left[u'(x)\right]$ Logarithmic function: Derive $\ln x=\frac{1}{x}$

Derive $\left(\ln u(x)\right)=\left(\frac{1}{u(x)}\right)\left[u'(x)\right]$

Basic Rules of Integration

(i) Exponential function: $\int e^{u}du=e^{u}+C$

(ii) Logarithmic function: $\int\left(\frac{1}{u}\right)du=\ln u+C$